

§ 4b.612 Flight and navigational instruments--(a) Air-speed indicating systems. (1) Air-speed indicating instruments shall be of an approved type and shall be calibrated to indicate true air speed at sea level in the standard atmosphere with a minimum practicable instrument calibration error when the corresponding pilot and static pressures are applied to the instrument,

(2) The air-speed indicating system shall be calibrated to determine the system error, i.e., the relation between IAS and CAS in flight and during the accelerated take-off ground run. The ground run calibration shall be obtained from 0.8 of the minimum value of V_1 to the maximum value of V_3 , taking into account the approved altitude and weight range for the airplane. In the ground run calibration, the flap and power settings shall correspond with the values determined in the establishment of the take-off path under the provisions of § 4b.116, assuming the critical engine to fail at the minimum approved value of V_1 .

(3) The air-speed error of the installation, excluding the air-speed indicator instrument calibration error, shall not exceed 3 percent or 5 mph, whichever is the greater, throughout the speed range from V_{NO} to $1.3 V_{s1}$, with flaps retracted. and from $1.3 V_{so}$ to V_{FE} with flaps in the landing position.

(4) The air-speed indicating system shall be arranged in so far as practicable to preclude malfunctioning or serious error due to the entry of moisture, dirt, or other substances.

(5) The air-speed indicating system shall be provided with a heated pitot tube or equivalent means of preventing malfunctioning due to icing.

(6) Where duplicate air-speed indicators are required, their respective pitot tubes shall be spaced apart to avoid damage to both tubes in the event of a collision with a bird.

(b) Static air vent and pressure altimeter systems. (1) All instruments provided with static air case connections shall be vented to the outside atmosphere through an appropriate piping system.

(2) The vent(s) shall be so located on the airplane that its orifices will be least affected by air flow variation. moisture. or other foreign matter.

(3) The installation shall be such that the system will be air-tight, except for the vent into the atmosphere.

(4) Pressure altimeters shall be of an approved type and shall be calibrated to indicate pressure altitude in standard atmosphere with a minimum practicable instrument calibration error when the corresponding static pressures as applied to the instrument.

(5) The design and installation of the altimeter system shall be such that the error in indicated pressure altitude at sea level in standard atmosphere, excluding instrument calibration error, does not result in a reading more than 20 feet high nor more than 50 feet low in the speed range between $1.3 V_{so}$ (flaps extended) and $1.8 V_{s1}$ (flaps retracted).

(c) Magnetic direction indicator. (1) The magnetic direction indicator shall be installed so that its accuracy will not be excessively affected by the airplane's vibration or magnetic fields of a permanent or transient nature.

(2) After the magnetic direction indicator has been compensated, the calibration shall be such that the deviation in level flight does not exceed plus/minus 10 degree on any heading.

(3) A calibration placard shall be provided as specified in § 4b.733.

(d) Automatic pilot system. If an automatic pilot system is installed, it shall be of an approved type, and the following shall be applicable:

(1) The actuating (servo) devices shall be of such design that they can, when necessary, be disengaged positively and be overpowered by the pilot to enable him to maintain control of the airplane.

(2) A means shall be provided to indicate readily to the pilot the alignment of the actuating device in relation to the control system which it operates, except when automatic synchronization is provided.

(3) The manually operated control(s) for the system's operation shall be readily accessible to the pilot.

(4) The automatic pilot system shall be of such design and so adjusted that, within the range of adjustment available to the human pilot, it cannot produce hazardous loads on the airplane or create hazardous deviations in the flight path under any conditions of flight appropriate to its use either during normal operation or in the event of malfunctioning, assuming that corrective action is initiated within a reasonable period of time.

(e) Instruments utilizing a power supply. Each required flight instrument utilizing a power supply shall be provided with two independent sources of power, a means of selecting either power source, and a means of indicating the adequacy of the power being supplied to the instrument. The installation and power supply system shall be such that failure of one instrument, or of the energy supply from one source or a fault in any part of the power distribution system, will not interfere with the proper supply of energy from the other source. (See also §§ 4b.606 (c) and 4b.623.)

(f) Duplicate instrument systems. If duplicate sets of flight instruments are required by the regulations in this subchapter, each set shall be provided with a completely independent operating system. Additional instruments shall not be connected to the first pilot system. If additional instruments are connected to the other system, provision shall be made to disconnect or isolate in flight such additional instruments.

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